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POLAR METEOROLOGICAL OBSERVATIONS.

In 1875, at the meeting of the Association of German Naturalists and Physicists at Grätz, Lieut. Weyprecht brought forward the subject of Polar research, dwelling on the geographical character of the great Polar expeditions and their scanty results as regards other branches of science, and proposing that several expeditions should be sent out to make simultaneous physical observations for a considerable period. The matter was further discussed at the Meteorological Congress at Rome, and ultimately an International Polar Committee was formed. After two or three meetings the programme was arranged, twelve stations were fixed upon, to be equipped by Austria, Denmark, England and Canada, Finland, Germany, Holland, Norway, Russia, Sweden, and the United States. France and Germany arranged to carry on observations on the borders of the Antarctic area, and the Italian Antarctic Expedition promised to co-operate. The period fixed upon was from August 1st, 1882, to September 1st, 1883.

The work, which we have now to notice* is the first volume of results which we have received, and contains the records at Fort Rae, the station equipped by England and Canada. It is essentially a volume of observations, and can be best described by printing some extracts from the Introduction, quoting here and there from the tables, and adding a few running comments.

"Fort Rae is one of the posts of the Hudson's Bay Company. It is situated in Lat 62° 38′ 52″ N. (only 11° north of London), and Long. 115° 43′ 50″ W., on a bay on the northern shore of the Great Slave Lake, and was selected for occupation as being the most northerly of the Company's posts from which return would be possible, after the termination of the observations before the closing of the rivers." It consists of "some half-dozen log huts, with a large store for provisions, furs and goods for trading with the Indians."

Fort Rae is the nearest of all the Company's stations to the magnetic pole, and it presents another advantage of a practical nature. Provisions at the post are usually plentiful, and this is by no means the case in all parts of the

* Observations of the International Polar Expeditions, 1882-3, Fort Rae. London, Trübner & Co., 1886 4to, xiv-326 pages, 32 plates.

country. To have taken a year's full supplies for the party would have materially increased the cost and difficulty of transport.

It was decided that the organization should be military, and Capt. Henry P. Dawson, R.A., was appointed to command the party."

While wishing to say nothing in the least degree depreciatory either of Captain Dawson, or of the three artillerymen who accompanied him, we cannot help expressing our regret at the prevalent impression in high quarters that meteorology consists in reading barometers and thermometers accurately and punctually, and therefore that any one who can do that is a competent observer. This volume affords much evidence of the want of some one of recognized standing as a meteorologist as *attaché* to the expedition.

The following was the equipment of instruments provided :—

2 Kew pattern marine barometers.
2 aneroid barometers.
2 small cup anemometers.
1 rain gauge.
10 mercurial thermometers.
7 spirit thermometers.
2 maximum thermometers.
2 maximum (solar radiation) thers.
4 minimum thermometers.
2 minimum (terrestial radiation) thers.
2 hair hygrometers.
2 tubes for earth thermometers.
1 zinc thermometer screen (Wild's pattern).
1 unifilar magnetometer.
2 bifilar magnetometers.
2 declinometers.
1 Lloyd's balance magnetometer.
1 dip circle.
1 6 in. transit theodolite.
1 6 in. sextant and artificial horizon.
1 prismatic compass.
1 chronometer watch.
1 spectroscope with camera (Capt. Abney's pattern).
2 cameras, with dry plates, &c.

The latitude, longitude and time were all determined with the transit theodolite.

The dry and wet bulb mercurial and spirit thermometers were placed in a zinc screen of Professor Wild's pattern, with their bulbs 5 ft. 10 in. (1·77 m.) above the ground. During the winter this height was reduced by 8 or 9 inches, owing to the accumulation of snow. The maximum and minimum thermometers, and a hair hygrometer were placed in the same screen. In February a wooden roof was added to protect the screen from the rays of the sun.

The rim of the rain gauge was kept at a height of 1 ft. (·32 m.) above the surface of the ground or of the snow. The solar radiation thermometer was placed vertically with the bulb uppermost, and 5 ft. 8 in. (1·72 m.) above the ground.

The terrestial radiation thermometer was supported horizontally by two forked sticks, with its bulb one inch above the surface of the soil. During the winter it was placed on the surface of the snow, as also was an ordinary spirit thermometer, whose readings were recorded hourly in clear and calm weather for comparison with the air temperature at the time.

The earth thermometers were fastened to a lath at intervals of one foot, and placed in a copper tube, which was sunk vertically in the ground. As the surface had a slope of one in sixteen to the S.W., and as it was cleared of vegetation, it no doubt received more of the sun's heat than a normal portion of the earth's surface in that latitude. There was but little choice of position, owing to the rocky nature of the soil, a circumstance which prevented observations of temperature being made at a greater depth than four feet. At first the thermometers were placed in the tube without any packing, but as the weather be-

came colder they were so rapidly affected by the temperature of the external air, on being withdrawn from the tube, that there was not time to record their readings before they began to change; they were therefore, on the 4th of November, surrounded with strips of fur, and thenceforward the readings were much more regular. The fur, however, proved attractive to some beast of prey, probably a carcajou (wolverine), which on the night of the 11th of January managed to extract the thermometers from their tube, breaking them all. The observations were continued with other thermometers, which were coated with cotton wool, and no further interruption took place.

The position of the Observatory rendered it difficult to find a good position for the anemometer, on account of the hill to the north-east. Winds from this quarter were, however, rare, and the anemometer was well exposed to the prevalent winds, which were north-westerly and south-easterly. The estimated force by Beaufort's scale has been used in the reductions, a comparison having shown a close agreement with the anemometer readings.

There was little cloud in winter, and it was usually thin stratus and cirro-stratus, and did not appear to be at a high level. The S.W. wind was, however, attended with high cirrus clouds. A smoky haze was frequent in the summer, which was probably due to forest fires south of the lake.

Parhelia, paraselenæ, and haloes were of common occurence. On two occasions parhelia were observed at sunset between the observer and the opposite shore of the lake (distance four or five miles).

The prismatic colouring of cirrus and cirro-stratus clouds in the neighbourhood of the sun was frequently observed in the spring and summer, and was a phenomenon at times of great beauty. The colouring was once noticed to extend to a distance of 30° 40′ from the sun.

Aurora was observed on every clear night throughout the winter, as will be seen from the tables pp. 98-109. The journal of auroras has been printed *in extenso*, and the readings of the magnetic instruments at the time have been added, either as specimens of the disturbance that accompanies aurora, or where a marked change of reading has coincided with some phase of the phenomenon. The height of the aurora appeared to vary greatly; it was twice noticed between the observer and a mass of cloud.

It was not found possible to obtain photographs either of the aurora or of its spectrum. Captain Abney suggests that this was probably due rather to the effect of the low temperature on the sensibility of the plate than to the faintness of the light of the aurora.

The first snow fell on September 27th, but it was not until a month later that the lake froze. The residents all agreed that the season was a very exceptional one, the winter being unusually mild, and late in setting in. At the end of November the Mackenzie River was still nearly free from ice, whereas it is usually full of drifting ice in October, and frozen over in November. There was also much less snow than usual. A party of Indians who came in on January 16th, reported that the country 50 miles to the N.N.W. was quite bare of snow, the ground being not even white. The winter was also unusually free from storms, which, from all accounts, and from the journal kept at the station, seem to be both frequent and severe in ordinary years."

What a pity not to have had a copy made of the notes in this journal which bore upon the local climate, and thus to have preserved

records of past years, and afforded the means of comparing 1882-83 with them.

"The snow began to disappear about the middle of April, and the ice to break up on June 3rd. By the 16th it had entirely disappeared from the neighbourhood of Fort Rae, though it was visible for some time longer on the horizon in the direction of the main lake.

The trees first showed signs of budding on May 16th, and on June 1st they were in full leaf; when the party left the place on September 1st they were already yellow and beginning to lose their leaves.

The observations being concluded, the return journey was accomplished without difficulty, and England was reached on November 20th, 1883."

The tables of atmospheric pressure give hourly readings for the whole period, the average being 29·357 in., and the range from 28·400 in. in November, to 30·342 in. in February. There is, however, no information as to the altitude above sea level, but it is not improbably upwards of 500 ft.

The tables of air temperature are similar, and we have considered them sufficiently interesting to compile the following summary:—

AIR TEMPERATURE.

		Mean. °		Max. °		Min. °
1882	September ...	6·9	.....	20·4	.....	— 3·7
	October	0·3	.....	12·7	.....	—12·1
	November ...	—12·6	.....	1·4	.....	—35·7
	December ...	—26·2	.....	— 4·7	.....	—39·7
1883	January	—32·7	.....	—15·6	.....	—44·6
	February ...	—23·6	.....	— 3·5	.....	—39·9
	March	—22·1	.....	— 8·3	.....	—39·9
	April	— 7·1	.....	7·4	.....	—23·7
	May	2·4	.....	18·5	.....	—17·9
	June	10·8	.....	24·7	.....	— 2·3
	July...	16·2	.....	24·7	.....	8·7
	August	13·6	.....	25·6	.....	3·3

Vapour tension and relative humidity come next with the same detail, but how far the observations are reliable at such low temperatures, it is difficult to say. There are numerous entries of humidity below 10, and the min. 4 at 6 p.m, on January 9th, occurs between values of 92 and 64, in a dead calm, and with a fairly steady shade temperature. It would be interesting to ascertain what became of the moisture present in the air the hour before and whence it came for the hour after this reading, and also why the observer made no remarks upon such a phenomenon.

The work throughout is rather lacking in explanatory notes and several useful details are omitted, among others, the height above ground of the anemometer. The results printed are the wind force, estimated by the Beaufort scale, as the readings of the anemometer were found to agree closely with these values. The second anemometer was erected on an island in the lake but was frequently stopped by snow drifting into the works. Probably this difficulty was also experienced with the instrument at the Observatory.

The monthly means of wind force are as follows :—

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	August
3·0	2·9	2·4	1·5	1·4	2·4	2·1	2·3	2·5	2·5	2·7	2·6
4	0	0	0	5	16	0	0	0	0	0	0

The lower line gives the number of readings above force 10 in each month.

Forty-eight pages are devoted to the amount, form, and the direction of cloud, of which only the amount is summarized, and the tables are full of symbols, of which there is no explanation, and although the volume is evidently intended only for the use of advanced meteorologists, half a page of explanation to each set of tables would not materially have increased the size of the volume, and would, we think, have been useful.

The rainfall, or as it is wisely called the downfall, was apparently measured daily, and only yielded a total of 6·99 in. for the year in the following monthly amounts :—

Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	August
·43	1·01	1·10	·57	·19	·76	·04	·15	·24	·56	·74	1·20

There is no statement as to precautions taken to prevent snow drifting into the gauge, but with such strong winds as were frequent we think that some steps must have been absolutely necessary.

The hourly values of form and brilliancy of aurora, and observer's remarks on the display are very complete and valuable, and show a great frequency. The following summary is self explanatory :—

	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	April	May	June	July	Aug.
Period of Observation	7 p.m. to 4 a.m.	6 p.m. to 5 a.m.	5 p.m. to 7 a.m.	4 p.m. to 7 a.m.	5 p.m. to 7 a.m.	6 p.m. to 6 a.m.	7 p.m. to 5 a.m.	8 p.m. to 3 a.m.	11 p.m. to 2 a.m.	—	11 p.m. to 1 a.m.	9 p.m. to 3 a.m.
No. of Observations.	300	372	450	496	465	364	341	240	124	—	93	217
No. of Auroræ observed	99	107	145	218	220	169	226	103	16	—	13	76
No. of Days on which Auroræ occurred	25	22	26	31	31	27	30	26	11	—	9	28

The first line gives the period of the day during which hourly observations were made, observations of course being omitted during broad daylight ; the second line, the number of observations ; and the third, the number of observations at which the phenomenon was recorded, showing that during two-fifths of the time that it was dark enough for the phenomenon to be visible it was present, and that on only about one-fifth of the days of the year was it entirely absent.

By the way, the plural of aurora is printed *auroras*.

The readings of a black bulb max., *in vacuo*, are given for each day, but the observations are not worked up at all. The highest reading in sun is 60°·2, on June 23rd. Readings of a grass (or rather ground) min. appear in the same form, the lowest being 46°·7, on January 3rd, corresponding apparently with the reading of another thermometer on the ground which is stated to have read— 49°·6 at 9 a.m., on January 2nd.

In addition to this, hourly readings of a thermometer, exposed on ground, are printed in extenso, but we can find no description of the thermometer—whether bright or black bulb, mercury or spirit.

The observations of temp. of the ground at 1 ft., 2 ft., 3 ft., and 4 ft., were taken daily during part of the time and bi-daily during the remainder. In this table the — signs are partly inserted against each reading and partly given only at the top of the columns in a somewhat misleading manner, and several entries are in ( ), without any reason being assigned. The max. and min. at the different depths are as follows:—

Depth.	1 ft.		2 ft.		3 ft.		4 ft.	
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
Temp.	11·6	—15·7	6·1	—9·0	3·9	—5·9	2·7	—4·6
	July	Jan.	Aug.	Jan.	Aug.	Mar.	Aug.	Mar.
Date	21	19	5, 7, 13	18	5, 11, 17	29 Apl. 1	17	31 to Apl. 9

After the meteorological records come nearly 150 pages of magnetic observations, hourly readings of the three elements, Horizontal Intensity, Declination and Vertical Intensity, very thoroughly worked up, and in addition, term day observations (which occurred twice a month), when readings were taken every five minutes. As these observations would not be of such general interest to our readers as those of the meteorological elements, we do not purpose going through them in the same manner.

The work, as a whole, is a store of observations of interest to every meteorologist in the world, and with the records of the other stations, will form a mass of material whose value cannot be estimated, and when the whole has been thoroughly discussed, as it no doubt will be by the International Polar Commission, we hope that our knowledge of the physics of the Polar regions will be greater than could have been obtained by isolated expeditions during hundreds of years.

WHIRLWIND AND WATERSPOUT IN SOUTH WALES.

The electrical disturbance which occurred in London on the morning of Saturday, September 4th, seems to have been very general, and other storms with even more unhappy results prevailed during the later hours of the day. Of these by far the most serious and alarming was that which during the afternoon was accompanied at Dowlais by a destructive whirlwind, and at Swansea by the bursting of a waterspout with terrible effect, amounting indeed in the suburb of Foxhole to the complete wreck of many homes though happily, as far as appears, without loss of life.

From the *Western Mail* we cull the following details :—

"At Dowlais terrible storms of rain, thunder, and lightning raged at intervals from an early hour on Saturday morning. The inhabitants were startled by terrific peals of thunder and torrents of rain which have seldom, if ever, been equalled in the district. Many low-lying places were flooded, but, comparatively speaking, the damage done was slight. About four o'clock in the afternoon a second frightful storm broke over the town, and for nearly an hour a darkness almost Cimmerian prevailed. Deafening peals of thunder, preceded by vivid flashes of lightning, were followed by a downpour of rain so heavy that objects could scarcely be discerned at a few yards distance. A remarkable phenomenon followed. Throughout the day there had been little or no wind, but almost immediately after the cessation of the rain-storm a violent whirlwind, moving in a southerly direction, passed suddenly over the town. Windows in many parts of the town were blown in, especially in Morlais Street, whilst hampers, crates, &c., standing outside greengrocers' shops were carried away. Several persons were blown down, and even a pony was blown over by the force of the whirlwind. It lasted only a few seconds, however, and for the rest of the night the storm subsided, only to break out again on Sunday."

At Swansea, the storm of the morning having given a hint of what was to follow, the weather brightened for a time until "at three the sky was again darkened by heavy clouds, most fantastically shaped, and for an hour a thunderstorm, accompanied by a perfect deluge of rain, prevailed. At both Swansea and the Mumbles vast streams of rain rushed down the hills with such velocity as to make deep watercourses in the centre of the roads.

But at Foxhole, a suburb of Swansea, what was elsewhere a torrent, took the form rather of an avalanche than that of anything else. This portion of the town is built at the base of Kilvey Hill, the highest eminence near Swansea, rising as it does 650 feet above the level of the sea. The side is almost as steep as a wall, but towards the base it slants somewhat, and here are rows of houses. There was a time when the side was covered with vegetation, but the fumes from the adjacent works having killed it there has been nothing to hold the earth together, and consequently a kind of rubble is all that keeps the rock from view. During the progress of the storm a waterspout was observed to travel from the bay in the direction of Kilvey Hill.

It burst, and immediately ensued a scene the like of which has probably never been seen in England. Great torrents rushed down the mountain side, cutting deep channels through which to pass, and carrying with it every obstacle, even to huge boulders weighing several hundredweight. These torrents or avalanches—for there were many of them—rushed down at a great rate to the first row of houses, and it is a curious fact that, though the walls of but few of these were demolished, the torrent never stopped, but, bursting in

back doors and windows, carried all the contents of the dwellings with it, while men, and women, and children were no more respected, there being cases where people were washed from a back room to a front room, out of the door, and down the hill to the houses below. Clothes and food, washed out in this unceremonious manner, were seen mingled with the earth which formed the avalanche, and hundreds of fowls, &c., accompanied them. Thus the earth continued its mad career till brought up at the base by a Midland Railway wall, the water continuing across the line—which was blocked for some time—till it found its level in the river.

All this time—half an hour elapsed from beginning to end—the most exciting and heartrending scenes were witnessed. Women and children were either dumb from fright or else screaming violently. Shrieks rent the air all round, and these mingling with the roar of the avalanche had an effect which was simply terrible. Mothers, at the imminent risk of their lives, rushed frantically in search of their children, and children, likewise, braved the dangers in order to find their parents.

Two children thus engaged were seen caught in the avalanche. In a moment one, aged only four, was buried in the *debris*, and the other would have suffered similarly had not Mr. Gwynne observed its terrible position. This one rescued, Mr. Gwynne endeavoured to save the other child. By the aid of a pickaxe, he succeeded, after great trouble and at the imminent risk of his life, in unearthing one limb after another, but not without himself being once dragged into the rush of earth and only saved with difficulty. Two little girls were in a front room. Down came the earth, the room was filled with great blocks of stone and rubbish, and the children well-nigh suffocated, when crash went the front door, and both children and *debris* were carried through a huge drain made by the rush of water. Their precarious position was observed by a man named Stephens, who, going to the rescue, also got caught in the current. The children clung to some rocks and were saved, but Stephens, notwithstanding the efforts of two men, who were also carried along with him, was washed a couple of hundred yards, and only escaped death by clinging to the top of a lamp-post against which he was dashed. His injuries are the loss of some fingers, while his arms are badly cut.

Another instance which illustrates the terrible force of the current of water and rock is the following:—A fishwoman was walking along the back of Foxhole Road, when she was caught, washed into a house, and, after the storm had subsided, people, attracted there by her screams, saw that she had been carried through the house into the front room, dashed into a corner, and covered up to the shoulders with the stones which filled every room in the house. In order to get her out, it was actually found necessary to use crowbars, so tightly was the earth forced into the room, and so heavy were some of the stones. The poor woman, who was in a fearful state, was at

once removed to the hospital. Several other people are also seriously injured, but, as far as can at present be ascertained, no lives have been lost."

It is estimated that altogether about 8,000 tons of earth and rock were carried down the precipitous sides of the mountain by this awful torrent. About 40 families have been rendered homeless, and as, from the condition of the hill side, there is reason to fear further devastation with the next heavy rain, a general exodus has taken place.

The extremely local character of the fall is proved by the fact that the three nearest rain gauges all collected less than two inches, viz., Swansea Dock, 1·13 in.; Penllergare, 1·73 in.; and Morriston, 1 93 in.

LAND AND SEA BREEZES.

To the Editor of the Meteorological Magazine.

SIR,—I write for information on a subject which may be well understood, but about which I am ignorant, viz., a circumstance connected with the alternation of land and sea breezes which occurs near the coast in fine weather. I have noticed here that there are various ways in which the change from one to the other takes place, and that there are certain ways which are most frequent. I have not counted the number of times each occurs, but my impression is that there are four ways which are especially frequent; of these I do not know which is the most common; they are the following:—

1st.—The wind is westerly at night and veers through N. to E., returning in the evening by veering through S. to W.

2nd.—The wind is N.W. at night, changes through N. to N.E. and back in the evening through N. to N.W.

3rd.—The wind is S.W. at night, changes through S. to S.E., and returns in the evening through S. to S.W.

4th.—The wind is westerly at night, and falls to a dead calm in the morning when the easterly breeze springs up, again falling to a calm in the evening before the west wind arises.

The second and third of these modes are evidently the result of a general tendency to blow from the N. or S. respectively. Besides these regular modes of change there are numerous irregularities of various kinds, but the reverse process to that of No. 1 very rarely, if ever, occurs. There must, therefore, be some reason to cause the tendency of the wind to veer rather than to back. The cause of this tendency may be, however, well known, and my enquiring about it simply shows my ignorance. If it is not known, the only reason that occurs to me to explain it is the position of the sun. It may be that the ground gets more rapidly heated towards the S. of the place of observation towards noon, owing to the sun's greater altitude there, and that in the evening it gets more slowly cooled towards the north

owing to the sun being then at a greater altitude on that side, and so a draught is produced towards the direction in which the ground is hottest.

I find the course of the wind here on a normal fine summer's day may be well represented on the following suppositions—that the duration of the land breeze from the dense air above the cooled land is rather longer than that of the sea breeze which blows in the day time towards the rarefied air above the land—that these breezes reach their greatest force a little after midnight and noon, gradually dying away in the morning and evening—that the breeze towards the sun reaches its greatest force at noon, and is imperceptible when the sun is below the horizon—that these three breezes are about equal in maximum force—and that they do not blow straight towards the rarefied air, but two points further to the right. Naturally I should have expected that the rarefied air towards the sun would not lie directly towards it, but that the heating effect of the sun upon the ground would take a little while to reach its height; and that its direction therefore would lag behind the direction of the sun, and its greatest intensity be reached after noon. Such a supposition, however, does not seem to satisfy the facts so well, unless we assume that the wind blows directly towards the region of lowest barometric pressure instead of to the right of it. The supposition that the land breeze lasts longer than the sea breeze may also be avoided if we make the additional supposition of a *general* wind from the west, which is not an improbable one.

But if the hypothesis of a breeze towards the sun is correct, it ought to be exemplified in places far inland. I should like to ask if any such tendency of the wind is to be observed at inland stations? I have never seen any mention of it in meteorological works, nor have I been able to find any explanation of the phenomenon in question. Loomis, in his "Meteorology," page 87, states that the diurnal change of temperature produces a sensible effect in modifying the direction of the wind; but the only example he gives is at Newhaven, which is on the sea coast, and all the change he mentions is that of the ordinary alternation of sea and land breezes. "B. S.," in the *Encyclopedia Britannica*, last edition, describes the way the wind changes on the Berwickshire coast, whereby it appears that it is much the same as here; but he does not give any reason why the wind veers rather than backs.

I should add that the coast here faces about the same way as the general direction of the east coast of England, viz., E.N.E.

T. W. BACKHOUSE.

Sunderland, August 30th, 1886.

A SHOWER OF SNAILS.

To the Editor of the Meteorological Magazine.

SIR,—I am sorry I have not been able to reply to your letter sooner, but am away from home. I am afraid I cannot give the information as to the shells being found in rain-water gutters, as I was not told of the occurrence until nearly three weeks after it happened, the farmer in whose fields they fell being of a somewhat uncommunicative nature, and hence the snails had crawled off the elevated places in order to get food, and moreover, there is no dwelling house within the limits of the fall. A correspondent states in one of our local papers that the ground in places was covered to a depth of three inches, and when I visited the locality, after a lapse of nearly three weeks, I should say there were from one to two thousand shells per square yard, but only within the small acreage of the fall.

I note what you say as to the abundance of the shells in Cornwall, and I may say that they are exceedingly plentiful on the sand hills on the coast, but they have never before been seen in the cultivated lands where the fall took place, nor indeed within many miles.

Had I been at home I should have visited the locality again, but under the circumstances, I am afraid at present I cannot give much more information.—Yours faithfully,

ALFRED H. JENKIN.

Tregullas House, Lizard, R.S.O., 14th August, 1886.

To the Editor of the Meteorological Magazine.

SIR,—In your number for the present month, you head a letter "A Shower of Snails." A respected correspondent, in answer to my request, writes thus:—

> "I am afraid I can give you no further particulars about the shower of frogs (at Lyston Hall, Suffolk). It was in the July of 1842 or 1843. They came down in a very heavy shower of rain; in fact, were you to insert "frogs" for "snails," the account in the magazine would be a correct description of what I remember. The gardeners were called to sweep up the frogs, and carried them away in *wheelbarrows*, and said they were *all* [the way] down the avenue. I have often told this, and have always been laughed at."

Yours faithfully,

SUBSCRIBER.

Dreghorn Castle, 24th August, 1886.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1886.

STATIONS. (Those in italics are South of the Equator.)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		0-10
England, London	47·7	13	19·4	10	38·4	29·5	30·8	87	82·6	14·7	·63	8	7·2
Malta	63·2	5	43·1	7	59·8	48·8	47·2	83	121·0	37·5	3·39	11	4·8
Cape of Good Hope	98·0	6	51·2	14	83·4	60·7	58·7	68	...	...	·00	0	2·6
Mauritius	88·4	1,11	71·4	4	85·7	74·2	70·3	75	143·6	64·1	4·26	18	5·3
Calcutta	91·5	27	46·7	6	82·1	57·9	54·6	63	146·0	35·2	·00	0	7·2
Bombay	86·6	12	58·1	3	82·0	67·0	62·4	67	142·3	45·9	·00	0	1·7
Ceylon, Colombo	93·0	24	67·0	4	89·7	72·3	69·6	68	148·0	56·2	·29	5	2·2
Melbourne	104·1	19	45·9	14	72·4	53·9	51·4	68	150·9	33·0	1·54	10	6·4
Adelaide	105·7	18	49·1	7	80·7	57·5	48·2	48	161·0	41·4	·36	4	4·1
Wellington	78·0	9	51·0	2	70·4	57·8	56·2	74	142·0	46·0	1·77	7	4·3
Auckland	81·5	8	58·0	12	76·0	62·2	58·2	69	153·0	48·0	5·02	13	6·7
Jamaica, Kingston	90·5	19	65·0	8	85·1	68·8	67·8	78	...	...	1·03	...	3·9
Barbados	81·0	10	67·0	15	80·0	70·0	69·3	75	144·0	...	·86	7	5·0
Toronto	41·7	9	—22·8	5	25·9	10·3	19·2	84	...	—27·0	3·08	18	6·7
New Brunswick, Fredericton	50·8	13	—17·3	5	25·8	5·5	15·5	79	...	...	4·66	15	5·7
Manitoba, Winnipeg	46·0	7	—41·6	3	12·3	—11·6	3·5	92	...	...	·50	7	5·0
British Columbia, Victoria	56·0	5	28·0	1	47·7	37·6	...	...	...	..	3·17	13	...

REMARKS, FEBRUARY, 1886.

MALTA.—Mean temp. 53°·7; mean hourly velocity of wind 11·3 miles; velocity averaged 36 miles per hour from 4 p.m. on 8th, to 8 a.m. on the 9th. A very heavy sea followed for 3 days. TSS on 5th, 6th and 10th. H on 6th. J. SCOLES.

Mauritius.—Rainfall ·65 in. below, and mean temp. of air 0°·7 above average; mean hourly velocity of wind 10·2 miles; extremes 26°·3 miles on 24th, and 1·9 miles on 17th. T and L on 5 days; T on 2; L on 3. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 3°·, of dew point 1°·8, mean pressure ·046 in., and rainfall ·44 in. below their respective averages; mean humidity 2, and mean amount of cloud 1·1 above their averages. Prevailing winds S.W. and S., strong on 6 days. A hot wind blew on 18th and 19th. L on 5th, H on 6th, dense fog on morning of 10th. R. L. J. ELLERY, F.R.S.

Adelaide.—By far the coldest February ever experienced at Adelaide; mean temp. 5° below average, and 1°·8 lower than any other in February since 1857. W. E. COOK.

Wellington.—Generally fine till 8th; heavy R on 9th with slight T; from 10th to 16th pleasant, with N.W. wind; from 17th to 19th dull and showery; ·66 in. of R being recorded on 18th, the max. for the month; the remainder of the month fine, bright and warm, with N.E. and N.W. winds, usually light. Altogether a fine month. Rainfall 1·78 in. below, mean temp (64°·1) 1°·6, and pressure ·022 in. above average. R. B. GORE.

Auckland.—A warm, damp month, with rather strong variable winds. Mean temp., pressure. and rainfall all somewhat above the average. T. F. CHEESEMAN.

JAMAICA.—The rainfall over the whole island was nearly twice the average. A shock of earthquake was felt at the western end on the 9th, and a slight shock at Kingston on the 20th. At Montego Bay the temp., which on 8th and 9th was 67°, fell on the morning of 10th to 56°, which is probably the lowest ever recorded there. MAXWELL HALL.

BARBADOS.—Pressure not steady, and ·06 in. lower than the average; mean temp. (74°·6) 1°·2 above the average. Prevailing wind N.E.; mean hourly velocity 13·7 miles, 22 per cent. above average; extremes 21·7 miles, and 9·8 miles per hour. Rainfall much below average. Four days were more or less cloudy. L on 28th. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, AUGUST, 1886.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·33	XI.	Castle Malgwyn	1·57
,,	Margate, Birchington...	1·45	,,	Rhayader, Nantgwillt..	2·71
,,	Littlehampton	1·13	,,	Carno, Tybrith	2·18
,,	Hailsham	1·53	,,	Corwen, Rhug	1·25
,,	I. of W., St. Lawrence.	...	,,	Port Madoc	3·17
,,	Alton, Ashdell.....	1·43	,,	I. of Man, Douglas	2·52
III.	Winslow, Addington ...	1·89	XII.	Stoneykirk, Ardwell Ho.	3·56
,,	Oxford, Magdalen Col...	1·65	,,	Melrose, Abbey Gate ...	1·42
,,	Northampton	1·76	XIII.	N. Esk Res. [Penicuick]	2·25
,,	Cambridge, Beech Ho...	2·73	XIV.	Ballantrae, Glendrishaig	2·57
,,	Wisbech, Bank House..	1·74	,,	Glasgow, Queen's Park.	1·70
IV.	Southend	...	XV.	Islay, Gruinart School..	2·69
,,	Harlow, Sheering	1·14	XVI.	St. Andrews, Pilmour Cot	1·13
,,	Rendlesham Hall	1·35	,,	Balquhidder, Stronvar..	3·54
,,	Diss	1·29	,,	Dunkeld, Inver Braan..	1·22
,,	Swaffham	2·84	,,	Dalnaspidal H.R.S. ...	2·17
V.	Salisbury, Alderbury...	1·01	XVII.	Keith H.R.S.	1·86
,,	Warminster	1·20	,,	Forres H.R.S.	1·12
,,	Calne, Compton Bassett	1·37	XVIII.	Strome Ferry H.R.S....	3·79
,,	Ashburton, Holne Vic..	3·01	,,	Tain, Springfield.....	1·08
,,	Holsworthy, Clawton...	1·86	,,	Loch Shiel, Glenaladale	6·76
,,	Hatherleigh, Winsford.	2·04	,,	S. Uist. Ardkenneth ...	2·65
,,	Lynmouth, Glenthorne.	2·08	,,	Invergarry	3·30
,,	Probus, Lamellyn	2·06	XIX.	Lairg H.R.S.	·90
,,	Wincanton, Stowell Rec.	1·35	,,	Forsinard H.R.S.	2·39
,,	Taunton, Lydeard Ho ...	1·63	,,	Watten H.R.S.	2·59
,,	Wells, Westbury.....	2·23	XX.	Dunmanway, Coolkelure	5·92
VI.	Bristol, Clifton	2·39	,,	Fermoy, Gas Works ...	2·37
,,	Ross	1·46	,,	Tralee, Castlemorris ...	3·68
,,	Wem, Sansaw Hall.....	...	,,	Tipperary, Henry Street	2·87
,,	Cheadle, The Heath Ho.	1·71	,,	Newcastle West	2·75
,,	Worcester, Diglis Lock	1·64	,,	Miltown Malbay.....	3·88
,,	Coventry, Coundon	1·85	XXI.	Gorey, Courtown House	2·30
VII.	Melton, Coston	2·11	,,	Navan, Balrath	3·17
,,	Ketton Hall [Stamford]	1·72	,,	Mullingar, Belvedere ...	2·37
,,	Horncastle, Bucknall ...	1·97	,,	Athlone, Twyford	2·51
,,	Mansfield, St. John's St.	1·69	XXII.	Galway, Queen's Coll...	3·43
VIII.	Macclesfield, The Park.	2·91	,,	Clifden, Kylemore	6·82
,,	Walton-on-the-Hill.....	1·69	,,	Crossmolina, Enniscoe..	2·80
,,	Lancaster, South Road.	1·96	,,	Collooney, Markree Obs.	3·08
,,	Broughton-in-Furness ..	2·42	,,	Carrick-on-Shannon ...	2·98
IX.	Wakefield, Stanley Vic.	1·41	XXIII.	Rockcorry.....	2·33
,,	Ripon, Mickley	1·90	,,	Warrenpoint	1·95
,,	Scarborough.....	1·82	,,	Newtownards	2·15
,,	East Layton [Darlington]	1·45	,,	Belfast, New Barnsley .	3·23
,,	Middleton, Mickleton ..	1·13	,,	Cushendun	1·87
X.	Haltwhistle, Unthank..	1·24	,,	Bushmills	2·02
,,	Shap, Copy Hill	2·32	,,	Stewartstown	2·25
XI.	Llanfrechfa Grange	1·79	,,	Buncrana	1·86
,,	Llandovery	1·99			

AUGUST, 1886.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg	Date	Min. Deg	Date.	No. o Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	·76	— 1·98	·14	9	12	88·4	30	44·6	3	0	0
II.		Maidstone (Hunton Court)...	2·46	+ ·22	1·25	9	10	...	...	...	...	..	...
,,		Strathfield Turgiss	·89	— 1·53	·21	10	8	83·7	30	45·4	1	0	0
III.		Hitchin	1·17	— 1·11	·25	1	10	84·0	30*b*	46·0	2	0	...
,,		Banbury	1·64	— 1·06	·50	13	10	81·0	31	42·0	3	0	..
IV.		Bury St. Edmunds (Culford)	1·50	— ·67	·28	10	13	85·0	31	39·0	2	0	..
,,		Norwich (Cossey)	...	...	...	...	...	...	...	...	...	..	...
V.		Weymouth(LangtonHerring)	1·13	...	·46	1	9	75·0	24	49·0	3	0	...
,,		Barnstaple.....	1·17	— 2·93	·43	9	10	78·0	24	48·0	5,18	0	..
,,		Bodmin	3·04	— 1·80	·85	13	17	72·0	26*c*	46·0	3	0	0
VI.		Stroud (Upfield)	1·87	— 1·30	·71	13	9	84·0	30	45·0	2,17	0	...
,,		ChurchStretton(Woolstaston)	1·54	— 2·54	·50	13	13	79·5	30	45·0	3	0	0
,,		Tenbury (Orleton)	1·46	— 2·26	·85	9	11	82·5	30	36·5	3	0	0
VII.		Leicester	1·80	...	1·03	9	13	85·6	30	44·0	3	0	0
,,		Boston	1·86	— ·75	·52	18	12	90·0	31	40·0	3	0	...
,,		Grimsby (Killingholme).....	...	...	...	...	...	...	...	...	...	...	...
,,		Hesley Hall [Tickhill].....	1·70	...	·31	9	14	84·0	30	41·0	5	0	0
VIII.		Manchester (Ardwick).....	...	...	...	...	...	...	...	...	...	...	...
IX.		Wetherby (Ribston Hall) ...	2·59	— ·04	·82	10	10	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·35	— 2·45	·64	15	16	77·0	30	38·0	4	0	...
X.		North Shields	1·95	— 1·14	·79	18	9	76·5	31	41·5	4	0	0
,,		Borrowdale (Seathwaite).....	8·72	— 2·32	2·20	15	15	73·5	24	40·5	4	0	...
XI.	WALES.	Cardiff (Ely).....	2·06	— 3·27	·53	15	13	...	...	...	...	...	...
,,		Haverfordwest	1·90	— 3·07	·47	13	13	73·0	29	40·0	2	0	...
,,		Plinlimmon (Cwmsymlog) ...	3·06	...	·63	26	15	...	...	...	...	...	...
,,		Llandudno.....	1·35	— 1·84	·39	12	11	71·3	30	44·8	4	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	2·00	— 2·27	·37	21	15	70·6	23	37·2	3	0	...
,,		Jedburgh (Sunnyside).....	·93	— 2·44	·26	21	16	71·0	30	39·0	3	0	...
XIV.		Douglas Castle (Newmains)	...	...	...	...	...	...	...	...	...	...	...
XV.		Lochgilphead (Kilmory)	3·23	— 1·99	.55	30	19	...	...	36·0	2,3	0	...
,,		Oban (Craigvarren)	3·58	...	·75	30	24	67·8	13	43·0	4	0	..
,,		Mull (Quinish).....	3·19	...	·44	30	24	...	...	...	...	...	...
XVI.		Loch Leven Sluices	1·60	— 2·48	·50	11	7	...	...	...	...	...	...
,,		Arbroath	1·29	— 2·04	·68	10	7	71·0	29	43·0	3	0	...
XVII.		Braemar	1·37	— 3·06	·96	10	13	68·4	6	34·5	18	0	5
,,		Aberdeen	1·01	...	·17	10	11	75·0	20	38·0	3	0	...
XVIII		Lochbroom	3·45	...	1·21	1	19	...	...	...	...	...	...
,,		Culloden	·88	— 2·12	...	...	...	69·0	30	41·0	22*e*	0	1
XIX.		Dunrobin	..	...	...	...	...	...	...	...	...	...	...
,,		Kirkwall (Swanbister)..... ..	2·31	...	·47	1, 11	20	68·4	20	37·0	4	0	...
XX.	IRELAND.	Cork (Blackrock)	2·77	— 1·06	·63	11	19	78·0	6	46·0	10	0	...
,,		Dromore Castle	3·82	...	·60	14	17	69·0	8	43·0	2	0	...
,,		Waterford (Brook Lodge) ...	3·04	...	·76	12	17	74·0	6	44·0	11	0	0
,,		Killaloe	2·26	...	·35	21	21	72·0	var.	48·0	14	0	...
XXI.		Carlow (Browne's Hill)	2·16	— 1·57	·53	21	20	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	1·50	— 1·68	·37	21	13	75·6	30	47·0	11	0	0
XXII.		Ballinasloe	2·45	— 1·58	·30	20	21	70·0	5	41·0	1	0	0
XXIII		Waringstown	2·44	— 1·00	·32	12*a*	15	75·0	6*d*	42·0	3	0	...
,,		Londonderry (Creggan Res.).	2·16	...	·38	30	20	...	...	...	...	...	...
,,		Omagh (Edenfel)	2·70	— ·95	·52	6	19	69·0	29	42·0	20	0	...

a And 21. *b* And 31. *c* And 27. *d* And 8, 20, 29. *e* And 23.
+ Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON AUGUST, 1886.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min for Minimum; T for Thunder; L for Lightning; T S for Thunderstorm; R for Rain; H for Hail S for Snow.

ENGLAND.

STRATHFIELD TURGISS.—The weather of the early part of the month was generally unfavourable to agricultural and harvest operations and detrimental to the quality of the grain crops. The sky was overcast and the atmosphere loaded with moisture, and the nights were cold and foggy. The latter part of the month was, on the other hand, magnificent for harvest work.

HITCHIN.—The hottest August in our record.

BANBURY.—A favourable month for agriculturists, with great crops of pears and plums. Mean temp. 61°. TS on 12th, haze on 22nd and 29th.

LANGTON HERRING.—Rainfall 1·45 in. below the average; no R fell during the last 15 days, during which time a good wheat harvest was carried in excellent condition. Mean temp. (63°·1) 0°·6 above the average of 15 years. The prevalence of fogs, which occurred on eight days, is the most noticeable feature of the month. Solar halo on 3rd.

BODMIN.—A very genial month, with glorious weather for the abundant harvest.

WOOLSTASTON.—A favourable harvest month, the latter part being extremely hot. Mean temp. 60°·2. Severe TS on 13th.

ORLETON.—The temperature was low till the 18th, and the sky was generally covered with clouds with the exception of a few days about the 6th, on which day the temperature rose to 81°·2. From the 18th till the end the weather was fine and dry, and the temperature high, the mean of the month being about 0°·3 above the average of 25 years. A heavy, steady fall of R took place on the night of 9th. Pressure was generally high and steady. Distant T on 13th, L on night of 26th, dense fog on 24th and 30th.

LEICESTER.—A seasonable month; dry upon the whole, and very hot at the close.

BOSTON.—Harvest commenced generally in this district on the 24th. The weather towards the end of the month was very hot, the temp. in shade during the day varying from 87° to 90°. Fruit crops generally very abundant, plums especially plentiful, some trees being so laden as to break the branches.

WALES.

HAVERFORDWEST.—On the whole a fine harvest month with no excessive temperature, though 70° and upwards was registered on eleven days. There was very little sunshine. Close, damp, foggy weather prevailed more or less during the last fortnight. The rainfall, however, was less than that of any August during 37 years, except in 1858 and 1880, in which years only 1·63 in. and ·64 in. fell. Corn crops were very fair, oats very good, and there was plenty of grass. Mean temp. 58°·8.

LLANDUDNO.—Nothing peculiarly excceptional occurred during the month as regards temperature, but the rainfall was less than half the average. With the exception of the 5th, which was rather windy and dusty, the first 9 days were bright and very fine, so also were the last 4, besides being the warmest of the month. The mean temp. (59°·7) was 1°·2 below the average, and there were 159 hours of bright sunshine. There were only two days without sun, but the aggregate was considerably less than in the preceding month. As a rule here the mean temp. of July is the highest of all the months, but this year, owing to the deficiency in July, August had the advantage by a small fraction. The total range of temp. (28°·3) was 2° below the average, and the diurnal range (11°·3) was also below the average to about the same extent. The weather on the whole was favourable for all green crops, but owing to the slight deficiency of temperature, the corn crops while fairly abundant in quantity were some-

what later than usual, though mostly cut by the end of the month. The health of the community was good and singularly exempt from the usual summer ailments.

SCOTLAND.

CARGEN.—A dull month generally. The mean temp (57°·2) was 1°·6 below the average, and the duration of sunshine was also small. Very little corn was cut at the close.

JEDBURGH.—The weather was dry and warm, especially during the last half of the month, and vegetation made great progress. The rainfall, although there were almost as many wet days as usual, was 1·69 in. below the average of 22 years. The fruit-bush crop was abundant and good. Corn reaping was fully a month later than usual, no corn being cut in this district until the 28th. T on 10th.

OBAN.—An equable rainfall with somewhat broken weather characterised the month and much improved the green crops, but haymaking was backward and the crop light. The mean temp. was lower than last year, but with a smaller daily range. S.W. and S. winds were almost constant. Fog on 6th and 23rd.

QUINISH.—A cool, unsettled, showery month.

ABERDEEN.—Fine and dry weather prevailed throughout the month, the rainfall being more than two inches below the average.

LOCHBROOM.—The commencement of the month was wet and stormy, but on the 3rd the weather became fine, and it proved a very fine month, indeed one the most delightful and seasonable for years. Grass was plentiful and hay well secured. Corn, though naturally late on account of the nature of the previous season, was filling and ripening at the close much better than had been expected.

CULLODEN.—An exceedingly dry month, no R having fallen from 1st to 10th and from 13th to 30th.

SWANBISTER.—From 1st to 12th cold and disagreeable weather prevailed, but from thence to the close the weather was the finest of the summer.

IRELAND.

BLACKROCK.—Generally damp, and often misty and close, though pressure was very high.

WATERFORD.—A dull, wet month, which interfered with harvest work very much. T on 5th and 10th, dense fog on 27th.

KILLALOE.—The rainfall was moderate in quantity, but falling on 21 days with generally close and sultry air, caused much loss and serious delay in hay harvesting. The grain harvest also is unusually late.

DUBLIN.—Although changeable and at times cool and dull, the weather for the most part was favourable. The leading characteristics of the month were: prevalent W. and S.W. winds, often fresh; clouded skies, and rather low temperature until towards the close, when it became much warmer. There was a complete absence of TSS, although sheet L was seen on the evening of 26th. Solar halo on 3rd, fog on 20th and 23rd, high wind on as many as eleven days. Mean humidity 82, mean amount of cloud 6·2.

EDENFEL.—The weather as a rule was moist and humid, the result being that while the usual August ripening of crops remained almost at a standstill, they increased more in bulk of haulm and straw than during any other month of the summer. With a fine September the largest crops for 20 years will be secured throughout Ireland.